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Soda, Water, and Convenience: An Evaluation of the Mexican Soda Tax

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By Benjamin Hager

A thesis presented in partial fulfillment of the requirements for completion of the Bachelor of
Arts degree in International Studies

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ABSTRACT**BENJAMIN HAGER: SODA, WATER, AND CONVENIENCE: AN EVALUATION OF THE MEXICAN SODA TAX**

This thesis seeks to evaluate the Mexican soda tax of 2014 by exploring the reasons for the tax and the underlying factors that the tax seems to ignore. This soda tax, in particular, was implemented to address obesity by curbing the consumption of sugary soft drinks due to the large quantities consumed by the Mexican populous. However, as this thesis shows there are some potential pitfalls in this type of obesity prevention policy. By exploring potable water data from the World Bank, the rural and urban non-communicable disease rates of two Mexican states, and the penetration of levels of the OXXO convenience store in each state compared to the obesity rates, an understanding of what a soda tax may ignore has been discovered. The results from exploring this data reveal that Mexico significantly lags behind other countries in terms of access to completely safe water, and there appears to be some urban and rural divide, especially in terms of income. It also reveals that more urban areas are suffering from higher rates of weight related non-communicable diseases. Finally, the OXXO penetration level data demonstrates that high densities of convenience stores may be correlated with higher obesity rates. In general this data shows that soda taxes can help curb consumption. However, in terms of real measurable changes to the health of the country, overweight rates and health care expenditures are still on the rise. Simply put, the cheap alternative to soda, water, appears to not be completely accessible for all populations. Additionally, rural regions with less obesity that rely on soda as a water alternative may be negatively affected by the soda tax, and convenience stores that sell other highly calorically dense foods are still incredibly accessible to the population, especially in regions with high obesity rates. Furthermore, it appears that the tax revenue from the soda tax is not assisting in improving water infrastructure. For this reason, certain issues should be addressed by the government to ensure the tax is working effectively and equitably for all regions of the country.

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1. Introduction

Soda taxes or sugar sweetened beverage (SSB) taxes are touted as a valuable tool in the fight against obesity and other weight-related non-communicable diseases according to the World Health Organization (2017). Mexico, which is a country that has a national SSB tax, has the potential to ignore certain inequalities and social determinants when fighting obesity through fiscal policy due to the lack of redistribution of tax revenue (Kilpatrick, 2015). These inequalities and social determinants include access to clean water and the availability of junk food through convenience stores. Additionally, the changing food environment is often considered a driver of obesity particularly for low and middle income countries such as Mexico (Turner et. al., 2019). Mexico is in the midst of its obesity pandemic, and there is a need to find ways to curb obesity and the prevalence of overweight individuals to prevent future overall health expenditures, but certain systemic issues such as access to clean water and urbanization should not be ignored. In this thesis, I explore if proper infrastructure exists for both rural and urban areas to have access to water as a cheap substitute for SSB. Additionally, I examine if rural and urban areas are experiencing obesity and other non-communicable diseases at similar rates according to census data. Furthermore, this thesis seeks to find if access to convenience stores such as OXXO, one of the largest convenience store chains in Mexico, is associated with obesity rates to highlight the danger of the substitution effect of SSB.

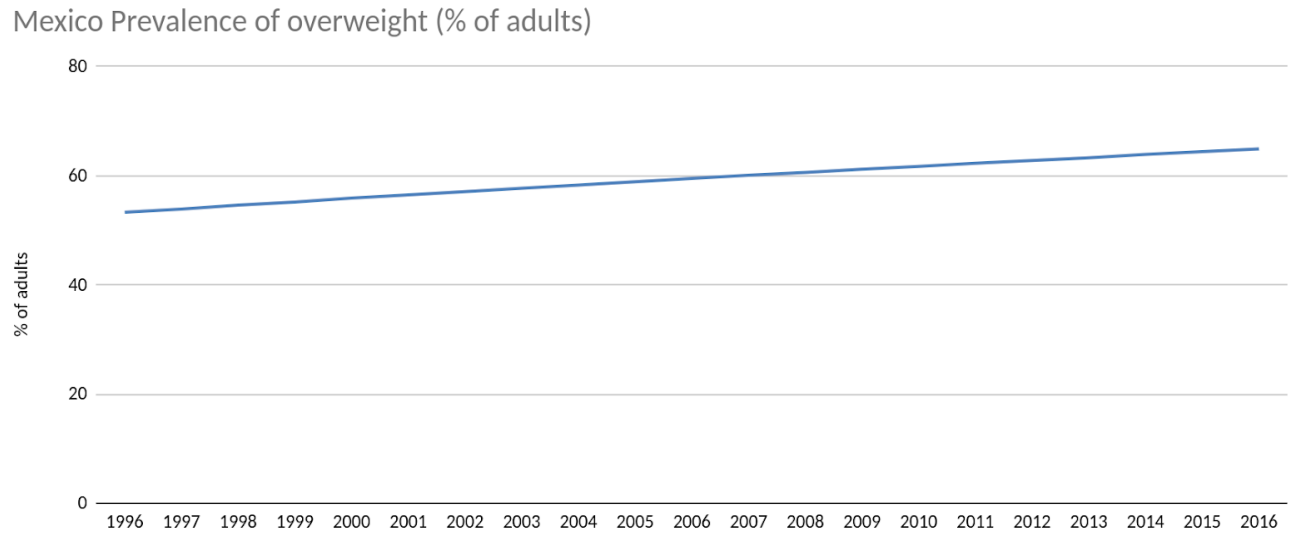
Background

Obesity is an issue for many countries, and health care costs have the potential to increase if the obesity rates are not curbed. Obesity, which in itself is an NCD, is associated with increases in the risk of other NCDs like diabetes and hypertension (Rtveladze et. al., 2014). Urbanization, modernization, and shifts to diets that emphasize meat over traditional staple plant

foods such as corn are all reasons that obesity has increased (Fox, Feng, & Asal, 2019). This has allowed processed foods and drinks to become incredibly accessible through supermarkets, fast food restaurants, and convenience stores, particularly in low and middle income nations (Turner et. al., 2019). Additionally, urbanization has created an environment for people to live more sedentary lifestyles. These changes in lifestyle have created the perfect environment for obesity rates to rise (Popkin, 1999)

In the context of Mexico, the obesity rate was 36.1 percent in 2015 (INGEI). An increase in eating food outside the home also occurred since the implementation of the North American Free Trade Agreement (NAFTA) which has led to further urbanization and food system changes (Torres & Rojas, 2018). NAFTA has allowed the consumption of fast food, processed foods, and sugary beverages to escalate due to these foods and drinks becoming much cheaper. Concerns that the obesity caused by these lifestyle changes will create drastic increases in both personal and governmental health care costs are just some of the reasons that Mexico has decided to use fiscal policy to help alleviate this public health crisis (Torres & Rojas, 2018).

Figure 1.

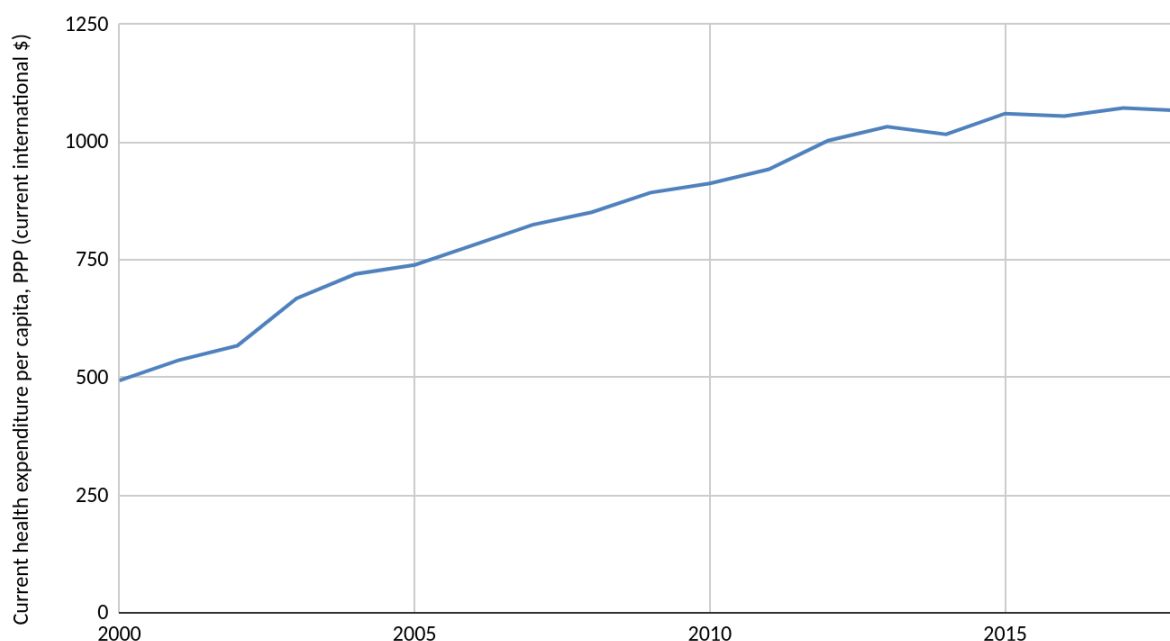


Source: World Bank Health Nutrition and Population Statistics 2021

The graph above illustrates how the weight crisis has been on the increase for many years. Overweight and obese individuals now make up over 60 percent of the population, and there has been a steady increase over the years according to the World Bank. This helps demonstrate the agency that is required in addressing Mexico's obesity pandemic and shows that no current obesity prevention policy has reversed the growing numbers of overweight individuals. Furthermore, the potential for these overweight individuals to acquire more financial burdens to their income from health expenditures is also an issue.

Figure 2.

Health Expenditure Per Capita: Mexico



Source: World Bank Health Nutrition and Population Statistics 2021

Clearly demonstrated above is the rising health expenditures for Mexico's citizens which can create a significant burden on individuals. This World Bank data demonstrates that there is a certain level of urgency in finding ways to offset health costs. Obesity and the other non-communicable diseases that come along with it certainly contribute to this rising number, so it is no surprise that policies would be implemented to make the population healthier.

The Mexican government implemented an SSB tax in 2014. To clarify what exactly is an SSB the authors Allcott, Lockwood, and Taubinsky state that the definition includes "any beverages with caloric sweeteners, including carbonated soft drinks, sports drinks, energy drinks, fruit drinks, milk-based drinks, and coffee and tea with added sweeteners, but not 100% fruit juice or "diet" drinks with low-calorie or zero-calorie sweeteners" (2018). The campaign to

institute the SSB tax was successful for a number of reasons including help from NGOs, an economic crisis, and the effectiveness of gaining political, public, and financial support before the opposition could implement a successful counter campaign (James, Lajous & Reich, 2020).

Given that Mexico has an obesity crisis and has decided to implement a soda tax as a way to lower obesity, it is important to evaluate the impacts and underlying issues that may be affected by this fiscal policy. An SSB tax is regressive which means that lower-income individuals will be more affected by the tax, and for this reason, underlying inequalities such as access to drinking water and rural and urban divides should be examined. Urbanization and the continued change of the food system also contribute to obesity. Convenience stores sell other processed foods besides SSB, so an examination of how much influence these stores have over different areas of Mexico may reveal where policy can go further (Allcott, Lockwood & Taubinsky, 2020).

Theoretical Framework

Regressivity of a tax is the idea that a tax has the potential to have the most effect on lower income individuals. This is a common theme of most sin taxes which include products such as SSB, tobacco, and alcohol. In many areas, SSB, in particular, are consumed at higher rates the lower an individual's income. However, a regressive tax must also offset the externalities that could cost lower income individuals more. SSB overconsumption, for example, can cause a plethora of health issues that could incur more costs on an individual in the long run. Mexico's health system is a combination of private and public hospitals. Certain types of social security exist for individuals that work in particular industries or serve in the armed forces. Additionally, there is a government provided insurance called Segura Popular to address inequality, but the health system is still incredibly burdened with Mexico's rapid growth (Puig et

al., 2009). Therefore, although SSB tax may have the highest impact on low income individuals, the other benefits of the tax have the potential to alleviate this cost. Although, certain underlying issues such as access to drinking water could highlight a potential pitfall in the Mexican SSB tax.

The problems expressed by regressivity relate to the idea of the social determinants of health. According to the World Health Organization, the social determinants of health are “the non-medical factors that influence health outcomes” which include “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life” (2021). For this reason, an examination of how income and geography have played a role in the implementation of the tax is important.

Urbanization is the process by which populations migrate into more urban regions which sees the shift away from rural professions and lifestyles. Urbanization in the context of the food system can be explained by the process of the nutritional transition. The nutritional transition is the shift from traditional diets to more “Western diets” that include more caloric dense foods such as fats and processed foods. Along with urbanization and the nutritional transition comes the burden of NCDs such as obesity, hypertension, and diabetes which are caused by the new diets and more sedentary lifestyle. Once a diet has transitioned it is very difficult to influence behavioral change (Popkin, 1999). To examine the urbanization and the nutritional transition and see how it has influenced Mexico, the OXXO penetration level and state obesity rates will be examined to see if there exists some patterns between convenience stores, which are in stark contrast to traditional diets, and the obesity rates of the Mexican states.

Data and Methods

In order to understand how an SSB tax may neglect certain systemic issues, the case of Mexico will be examined. Data was collected in relation to access to drinking water from the World Bank, obesity rates and other non-communicable disease rates (NCD) from the Instituto Nacional de Estadística y Geografía, and OXXO penetration levels from a Fomento Económico Mexicano investor presentation. The World Bank drinking water data is from the Health Nutrition and Population Statistics subcategory. The two types of drinking water indicators that will be examined are “using safely managed drinking water” and “using least basic drinking water services.” The ways in which these indicators differ are that “using safely managed drinking water” means there are no water contaminants and the source is accessible on the premises. “Using least basic drinking water services”, on the other hand, means that the source of the water does not have to be located on the premises and does not state whether water is free of contaminants. The date range for these indicators is 2011 to 2017. These water indicators were collected in relation to the Organization for Economic Co-operation and Development (OECD), Mexico as a whole, the rural populations of Mexico, the urban populations of Mexico, and also separated into wealth quintile by the top and bottom 20 percent of household income. Graphs were created to examine this information more clearly.

Data regarding obesity, hypertension, and diabetes for the Municipalities of Chiapas and Nuevo Leon is also examined to further highlight rural and urban differences. These municipalities were selected because Nuevo Leon contains the third largest city in Mexico, and Chiapas is a more rural and indigenous region that has a strong association with the country’s soda industry. The data was collected from the Instituto Nacional de Estadística y Geografía (INEGI) from the 2015 intercensal Encuesta Nacional de Salud y Nutrición. This survey also

contains the total population results from this survey, and the total population is used as a control to see if drastic differences exist between an urban and rural municipality.

Fomento Económico Mexicano (FEMSA), the company that owns OXXO, one of the largest convenience store chains in Mexico and Latin America, had 18,233 Mexican locations in 2019. To examine if the number of OXXO locations has an association with obesity, OXXO penetration levels were extracted from a FEMSA investor presentation. The presentation assigned each state of Mexico with a penetration level of low, moderate, or medium. For the sake of this thesis and clarity medium will be referred to as high. Low level means one store per 30,000 or more people, moderate means one store per 10,000 to 30,000 people, and high means one store per 10,000 or fewer people. The obesity data is also from the INGEI 2015 intercensal Encuesta Nacional de Salud y Nutrición. In order to see if OXXO and obesity have a relation, each state was assigned its respect obesity rate and OXXO level. Each level has a mean obesity rate to see if the OXXO penetration level had an overall effect on the obesity rates. Minimums and maximums will also be examined to see the variation of the levels.

Hypotheses

My hypothesis for the drinking water data is that there will be an urban and rural divide for “using least basic drinking water services.” However, I suspect that with the wealth quintile as a variable that there should be some noticeable difference between the rural and urban areas. For the obesity, hypertension, and diabetes rates of Chiapas and Nuevo Leon, Nuevo Leon should have higher rates than both the national and Chiapas due to being a more urban municipality. However, given Chiapas' relation to the beverage industry, it will be interesting to see if the municipality is actually lower than the rest of the country. For the OXXO and state

obesity rates, the data should align linearly, and the obesity rates should rise with each increase in penetration level.

Chapter Outline

Chapter two is a literature review of obesity as a public health issue, the obesity within Mexico and Latin America, SSB tax as public health policy, and an in-depth explanation of the SSB tax in Mexico. Chapter three is the first empirical chapter of this thesis and explores the water data extracted from the World Bank and compares NCD in Chiapas and Nuevo Leon to Mexico as a whole. Chapter four is the second empirical chapter of this thesis and compares the OXXO penetration data to the obesity rates of each state within Mexico. Finally, the thesis concludes by highlighting important results and discussing what the data means in the context of the SSB tax within Mexico.

2. Literature Review

Obesity: a Public Health Issue

Obesity has become a global issue in almost every region in the world. However, Latin America has experienced some of the most drastic increases in obesity. The globalization and introduction of new foods combined with a change in lifestyle have led to the obesity epidemic getting out of hand, especially in this region. Although obesity has become the trend since the food system and lifestyle changes that occurred in the 1980s, the region still faces the issue of malnutrition (Popkin & Reardon, 2018). Nonrural farm income has increased drastically, and the majority of rural citizens live in proximity to towns or cities with access to processed foods. The rise of the supermarket has also transformed the way that people buy food, and the popularity and convenience of supermarkets continue to rise with the introduction of e-commerce and the leasing of commercial spaces to fast-food chains. The food industry has shifted to commercial farming practices, and the populations within the area have become very urbanized. Therefore, farming and retail are both focused on meeting the new demands of the population. The demand is still for high sugar content and processed foods and drinks, so there is little incentive for producers to change to manufacturing healthier products (Popkin & Reardon, 2018).

For Mexico, the increase in obesity can be linked to the North American Free Trade Agreement (NAFTA) which led to changes in food production and more urbanization. In 2016 72.5 percent of the adult population was overweight. NAFTA fostered the changes in diet and relationships with food by changing the demands of food production. A shift from traditional diets to more processed foods occurred, and traditional foods such as grains, cereal, and legumes became less important to the Mexican diet. Mexicans also began eating more food prepared outside the home. In 1992 14.3 percent of food was consumed outside the typical Mexican

household, and in 2016 22 percent of food was consumed outside of the home. This situation is further complicated by the increase in non-communicable diseases like cancer, osteoarthritis, cardiovascular disease, and diabetes. Increases in these types of diseases lead to economic burdens on both the health system and individuals. In general, the Mexican people are more at risk for these diseases and predisposed towards obesity because of the industrialization of food, increases in intakes of fast food and sugary beverages, and the prominence of more sedentary lifestyles (Torres & Rojas, 2018).

Sugar intake is a primary concern in many places, and it does have an association with obesity. Specifically, SSBs are a significant contributor to added calories from sugar, and Mexico, in particular, struggles with heavy consumption of sugar and SSB. Mexico's mean sugar intake is higher than the WHO recommended number of <less 10% of total energy intake, and SSBs and other high sugar products have low satiety which means they do not provide the same amount of energy as other foods (Sanchez-Pimienta et. al., 2016). According to a American Society for Nutrition study "the prevalence of added sugar intake of >10% of TEI is high, ranging from 58% in school-aged boys to 85% in adolescent girls" which is astonishingly high (Sanchez-Pimienta et. al., 2016, p. 1889). Increased obesity, diabetes, and other non-communicable disease rates have been associated with SSB, and regulation of sugar is a tactic that has been implemented. SSB is the primary source of added sugar for Mexicans, and the implementation of the 2014 excise tax on sugar demonstrates that the government sees regulation of SSB as a way to manage obesity (Sanchez-Pimienta et. al., 2016).

Obesity is often referred to as a disease of modernity, and it is often the opinion of the public health officials and the WHO that this issue is caused by modernization. However, in *The Weight of Obesity* by Emily Yates-Doerr, it is revealed that our understanding of obesity,

modernization, and urbanization is not as linear as most officials frame it to be, and many parallels can be drawn between Mexico and Guatemala which is the country of interest in *The Weight of Obesity*. Yates-Doerr discusses how Latin America as a whole has seen a shift away from staple foods and a favoring of Western-style diets that include more animal protein and processed foods. This process is often referred to as a “nutrition transition.” The case of Guatemala demonstrated that aspects of indigenous culture such as the idea of the sensory balance of food are contradictory to the Western understanding of nutrition. Nutritionists in the area had many communication issues explaining the concepts of Western nutrition because indigenous people had their own understanding of nutrition that worked before the food system turned away from more traditional staples such as corn and beans. Furthermore, our measurements and understanding of nutrition are based on the norms of the Global North and assume that all bodies are the same and equal. For this reason, strategies for alleviating obesity can be less beneficial to bodies that are not regularly measured and have different understandings of larger bodies and food (Yates-Doerr, 2015).

In the case of Guatemala, BMI is important to note because it puts a strong emphasis on weight loss instead of healthy living. Being fat in Guatemala did not always correlate to someone being unhealthy, and rather being fat could be seen as a sign of living a good life with abundance. Yates-Doerr made clear that Guatemalans who believed this did not believe that obesity was a healthy lifestyle, but they held other aspects of life in high esteem besides having the desired thin body that countries such as those in the global North held in high esteem. This is another reason that a health issue like obesity is so hard to curb and understand. All bodies in the world are not the same which makes measuring and having a control for the ideal body incredibly difficult to apply to all regions. Additionally, understandings of what is healthy or

desirable differ depending on context and society (Yates-Doerr, 2015) What may be healthy in one region could be seen as unhealthy in another, and influences from other nations such as those in the global North can create unrealistic and achievable standards for populations that do not fit the same norms.

The example of the state of Chiapas in Mexico demonstrates how obesity and its understanding in relation to SSB is layered. The region is one of the rainiest, but many do not have access to potable water at all times. Furthermore, Coca-Cola and other SSB are more readily available than water. According to a *New York Times* article, “Coca-Cola, which is produced by a local bottling plant, can be easier to find than bottled water and is almost as cheap” (Lopez & Jacobs, 2018). Deaths related to diabetes have drastically increased. The situation is further complicated because a Coca-Cola bottling plant uses a significant amount of the available freshwater. The bottling plant does not claim responsibility for these increases in diabetes (Lopez & Jacobs, 2018).

However, the use of Coca-Cola is also ingrained in indigenous cultural practice which complicates the relationship between the beverage and diabetes. Sugary sodas, mostly Coke, have replaced traditional beverages both in everyday life and in ceremonies for many people in the region. For example, *The Guardian* states, “a bottle of Coke, believed to feed the good spirits and help the sick, is today as central a feature of many public and private rituals as incense, candles and sacrificial chickens” (Tuckman, 2019). Drinking soda has become a practice that begins in adolescents now, and addiction to sugary beverages starts at a very young age. Lack of readily available drinking water within the household has also added another layer of complication to the consumption of SSB which is safe to drink, albeit not healthy in large quantities. A bottling plant in the South of Mexico uses a significant amount of the clean water in

the region for Coca-Cola. According to activists, “the company has so overexploited the spring that the city of San Cristóbal is now facing water shortages” (Tuckman, 2019). Furthermore, according to *The Guardian*, “a Coke in a returnable glass bottle is often scarcely more expensive than bottled water” which demonstrates how creative promotions and marketing have been permitted to encourage the drinking of Coca-Cola (Tuckman, 2019).

As seen in the examples of Chiapas and Guatemala obesity is a complex issue that is affected by society, biology, and the environment. However, no matter the root cause of obesity or which intervention a country chooses to take, obesity is a costly health condition that can significantly burden the health system of a country. A study on Brazil demonstrated these contributions to health costs very clearly. For example, the cost of obesity and overweight related diseases reached \$2.1 billion in one year for the country. The main increase in health costs was attributed to cardiovascular disease, and being obese or overweight contributes to heart disease. Obesity related disease was equivalent to .09% of the Brazilian gross domestic product in 2010 (Coutinho et. al., 2012). It is clear that obesity and other non-communicable diseases drastically increase health costs for both the health system and the individual. For this reason, interventions to reduce obesity can be seen as an effective way to decrease health costs, but finding the right intervention to reduce obesity can be difficult and also raise moral, ethical, and economic concerns. These interventions can range from soda taxes, to food package labeling methods, advertising bans, and health education programs.

The primary issue with interventions is the dehumanizing factor of labeling obese and fat people as a burden to society. A backfire effect of making obese people feel guilty and bad could actually lead them to gain more weight or be less likely to attempt to lose. Substitution is another concern for the introduction of regulatory initiatives. People may simply consume a different

product that is unhealthy and hinder efforts to lower obesity. Therefore, while regulatory initiatives may be effective in lower consumption, they may not always lead to a decrease in obesity. If tax revenues do not redistribute revenue to education initiatives and other public health initiatives they may not be as effective (Bogart, 2013).

Soda Tax as Policy

A sugar-sweetened beverage (SSB) or soda tax is seen as an effective policy tool because overconsumption of sugar is a major cause of obesity and other non-communicable diseases. Furthermore, these drinks are particularly popular in low and middle-income countries. This form of regulation is also recommended by the WHO which recommends that taxes raise the price of SSB by 20 percent. These taxes according to WHO should lower consumption through price increases, but there are also other benefits that come with this form of policy. For example, these taxes also increase revenue, educate consumers, and create incentives to reform products. A number of countries have instituted this type of tax, and it has proven effective specifically for lower-income individuals with water being the expected substitute (Roache & Gostin, 2017). For example, Mexican sales “fell by 5.5% in the first year (2014) and 9.7% in the second year (2015)” having the most impact on lower income individuals (Roache & Gostin, 2017, p. 490). However, there are some concerns that targeting low income people may cause an unnecessary burden, and furthermore, these taxes can ignore institutional problems such as lack of clean drinking water access.

Opposition to SSB taxes is also a common phenomenon, and while beverage companies do oppose these taxes, there are many groups that oppose these taxes for specific reasons. A concern that both interest groups and beverage companies have is the economic side of SSB taxes. Both these groups cite that taxes have the potential to cause job loss by affecting

manufacturing and the supply chain. Denmark, for example, scrapped its SSB tax for this reason. Another concern for the use of an SSB tax is the potential added burden on lower-income consumers. Poorer consumers are usually disproportionately affected by these types of taxes and do not have easy access to healthier alternatives. Beverage companies also work hard to prove that calorie consumption is not just an issue from a supplier standpoint (Studdert et al, 2015).

Obesity in Mexico

Mexico has increasing obesity, hypertension, and diabetes. According to the intercensal Encuesta Nacional de Salud y Nutrición in 2015, 36.1% of the population over the age of 20 in Mexico was obese, 18.4% had hypertension, and 10.3% had diabetes (ENSAUT). Mexico is also no stranger to the societal shifts that go along with increased obesity. For example, the country has seen increased wealth, a population shift from rural to urban areas, and changes in diet to include more low cost but high calorie foods. In 2004 non-communicable disease accounted for 75% of total deaths. These obesity related alignments such as diabetes and hypertension have also led to a loss of productivity in the country due to premature death. A study published in 2012 projected the cost and severity of the obesity situation in Mexico and predicted how the situation would continue to the year 2050. This study found that by the year 2050, there will be more obese than overweight individuals and normal body weights will only account for 12% of the total population. Obesity will also increase across all age groups, and the data suggested reductions in BMI by even just 1% started in 2010 could result in thousands of fewer cases of cancer (Rtveladze et. al., 2014). This data and the data gathered from the ENSAUT demonstrate the severity of the obesity crisis in Mexico, and it does suggest that reducing obesity is a worthwhile measure to implement for the country.

There also exists some significant rural and urban divides within the context of health access in Mexico. Many Mexicans are uninsured due to working in the informal market and the limited resources of the state run health services which are free. The average uninsured rate in Mexico was about 50% for all regions, but these averages change depending on which state is examined. For example, rural states like Chiapas can have uninsured rates that reach almost 80% (Salinas et. al. 2010). Rural health services are extremely limited in Mexico which can lead to less longevity and the inability to seek treatment. A 2010 study found that older Mexicans were more likely to visit the doctor and spend time in the hospital if they lived in an urban area. This lack of insurance and services mean that health care can be costly and difficult to utilize. In urban areas, the ability to access health services or the likelihood of having insurance was significantly higher than in rural areas (Salinas et. al. 2010). An explanation of this phenomenon is that “since the poor, rural and uninsured households of Mexico incur the most out-of-pocket catastrophic health care expenditures, they may be deterred from obtaining timely outpatient treatment, leading to a greater utilization of inpatient care for the same conditions” (Salinas et. al., 6, 2010). It is clear that there is a divide between rural and urban regions in Mexico when it comes to health, and these divides demonstrate a clear issue in the Mexican health system.

Soda Tax in Mexico

Although consumers are the targets of an SSB tax, soda tax, or sugar tax, it tends to be the sugar and beverage industries that have the most complaints and campaigns against these types of fiscal health intervention. Since the Mexican SSB tax is the main subject of this thesis and an SSB tax that has passed, it is important to understand how this tax was opposed by the industries within the supply chain of SSB products. A study by Erin James, Martín Lajous & Michael R. Reich conveys the success of the Mexican SSB tax, despite strong industry influence

(2020). It is quite surprising that the Mexican SSB tax was successfully passed given its history with the Coca-Cola Corporation. Coca-Cola and both the Mexican government and Mexican society have had a strong relationship that has allowed the company to be ingrained into the culture. Coca-Cola has been a sponsor of sports in the country for many years and is a major contributor and sponsor of public health interest groups like the Mexican Diabetes Association. Former president Vicente Fox, elected in 2000, was the CEO of Coca-Cola Mexico, and the government and the company have created legislation to combat obesity-related issues (James et. al. 2020).

Coca-Cola is important to note in the case of Mexico because of this strong relationship, but other trade groups such as the Alianza Nacional de Pequeños Comerciantes which represents the sugar-cane industry and bottling industry also fought the tax. Although, it should be noted that these groups did not attack the tax directly. Instead, these companies and trade groups used lobbying organizations. The main argument that industry had with the sugar tax which is an argument that can pretty much be applied to any country attempting to enact an SSB tax is that it would harm small businesses, cause negative economic effects, and not actually prevent obesity. However, in the case of Mexico, a combination of support from civil society, NGOs, and timing permitted the successful passing of the tax in 2013 (put into effect in 2014). The government, academics, and NGOs were successful in garnering the public by publishing studies that demonstrated that an SSB tax would reduce obesity, lower consumption, and not cause a collapse of the SSB industry. Another reason for its success was that much of the planning for the tax was done privately which meant that industry opposition had less time to sway public opinion. Furthermore, in 2013 Mexico was suffering from economic issues due to oil prices, and an SSB

tax permitted the creation of another tax revenue stream. Assistance from outside groups like Bloomberg Philanthropies also assisted with streamlining the tax passage (James et. al., 2020).

The soda tax in Mexico was implemented in 2014, and the tax added 10 percent to the price of SSB (one-peso per liter). Studies have shown that in 2014 and 2015 there was an average decrease of 7.6 percent in SSB consumption. In the years prior to the tax, there were also campaigns to link diabetes and SSB consumption which has also been seen as a contributor to these decreases (Colchero et. al., 2017). In 2009 and 2013 there were restrictions put on the advertisements and promotions of SSB, and in 2010 the sale of SSBs was prohibited in schools. This made all sales of drinks except water illegal in primary schools, and it made drinks that exceed 10 calories per 250 ml prohibited in all schools (Bergallo et. al. 2018). The tax also led to increases in bottled water sales which increased by 16.2 percent in 2014 (Colchero, Molina, & Guerrero-López, 2017).

To summarize, SSB and obesity appear to be strongly associated with each other, and consumers are aware that excessive consumption of these types of beverages can lead to health problems. The modernization, demographic, and economic changes Mexico has experienced since the 20th century have led to a change in behavior when it comes to the food system, but some underlying issues exist. Mexico is now a country with a very large obese population that is continuing to grow at a significant rate. Furthermore, there exists a divide between rural and urban regions within Mexico in the context of health care access. The case of Chiapas and increases in bottled water sales convey that there are infrastructure issues when it comes to potable water access. The tax may be decreasing SSB consumption, but these types of beverages have cultural significance and act as a water substitute as seen in the case of Chiapas. Also, the structural changes to the food system have created an environment that facilitates high sugar

foods through business like convenience stores. Furthermore, it appears that rural areas have less access to health services, and it may be important to examine if rural areas are more or less healthy than urban areas in the context of conditions such as obesity, hypertension, and diabetes. Potable water access should be further examined to determine if there is an added burden on areas and citizens that do not always have access to potable water in the household. To further highlight how the changing food environment has affected obesity convenience store penetration will also be examined to demonstrate that the issue of obesity goes beyond SSB.

3. Water and Obesity Data

Water is the go-to substitute for SSB because water is not a calorically dense beverage. Water data was gathered in relation to Mexico to determine the past and more current infrastructure of the drinking water environment in the country. The two types of drinking water examined in this section are “using safely managed drinking water” and “using least basic drinking water services.” Both these drinking water indicators are from the World Bank database. Using safely managed drinking water is defined as “using drinking water from an improved source that is accessible on premises, available when needed and free from fecal and priority chemical contamination. Improved water sources include piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water” (World Bank). “Least basic drinking water services drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip. Improved water sources include piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water” (World Bank).

The use of least basic treating water is especially interesting and important because of its definition from the World Bank. The 30 minute collection time is concerning because it means that drinking water is not necessarily located in the home. Although, this indicator is still important because any access to drinking water is worthwhile. However, when compared to the use of safely managed drinking water, it is clear that access to drinking water can be very different for households. For example, this indicator would mean that the potable water source is located in the home or at least the same building which would save time on water collection. The convenience of water in the home or within the building may also prevent people from seeing SSB as a water substitute. Therefore, the analysis of this water data will seek to observe whether

there is convenient and large scale access to drinking water in Mexico before the implementation of the SSB tax and if there has been a substantive increase in water access since the tax went into effect.

There are also charts that organize the “least basic drinking water services” into rural and urban areas. Furthermore, this data is then organized based on wealth quintile. Wealth quintile refers to wealth divided into 20% segments for the population based on household income. The bottom quintile and the top quintile were organized into charts based on area. This data is particularly useful to examine because the SSB tax has been cited by previous research as being the most effective for low-income urban households (Colchero, Molina, & Guerrero-López, 2017). For this reason, water should be examined to see if these particular groups and the population as a whole has access to the best substitute for an SSB.

Municipal and state data was also gathered regarding obesity, hypertension, and diabetes. This data was gathered from the Instituto Nacional de Estadística y Geografía (INEGI), and it contains the results of the 2015 intercensal Encuesta Nacional de Salud y Nutrición. This survey broke down obesity, hypertension, and diabetes rates by state and municipality. It also contained the totals for the population as a whole. Therefore, Mexico, Chiapas, and Nuevo León were isolated to see the differences between the total population, a rural area, and an urban area in regards to obesity, hypertension, and diabetes.

Figure 3.

Percent Population Using Safely Managed Drinking Water: OECD Member States & Mexico.

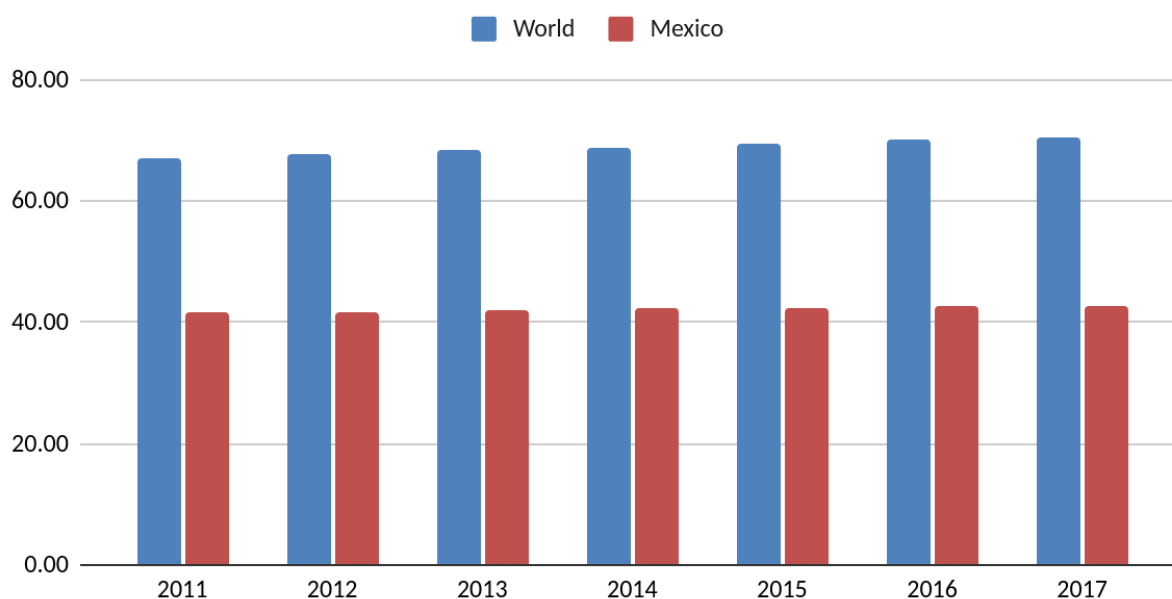


Source: World Bank Health Nutrition and Population Statistics 2020

The chart above demonstrates how Mexico lags significantly behind when it comes to the use of safely managed drinking water when compared to the rest of the OECD. Mexico has the third highest obesity rate in the organization, and other countries like Chile and parts of the United States have instituted SSB taxes. However given that the lowest percentage for the OECD as a whole is 91.44% in 2011 and the highest is 91.93% in 2017 it is clear that when it comes to safely managed drinking water Mexico is significantly behind. For example, Mexico recorded 41.56% of the population with safely managed water use in 2011 and 42.87% in 2017. Its highest is still 48.57% behind the OECD as a whole.

Figure 4.

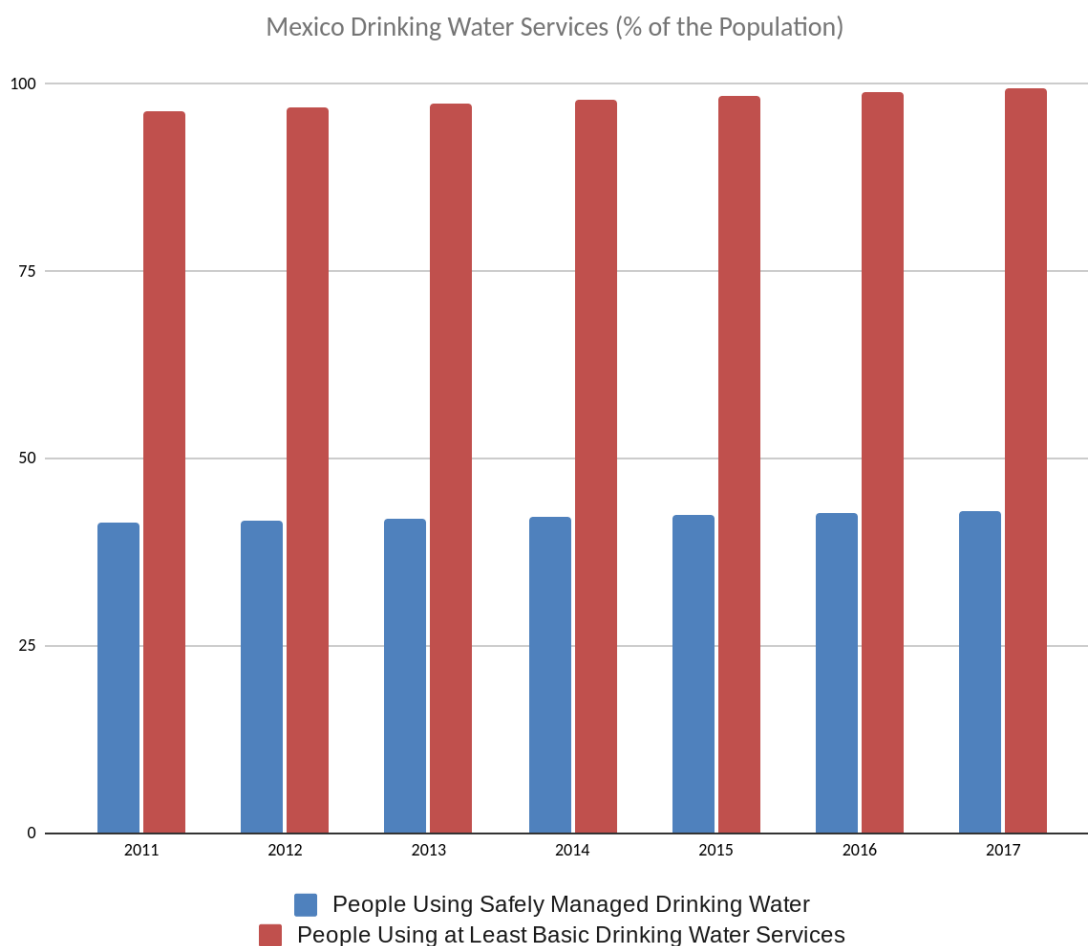
Percent Population Using Safely Managed Drinking Water: World & Mexico



Source: World Bank Health Nutrition and Population Statistics 2020

In the global context, Mexico still lags behind in people using safely managed drinking water. Mexico went from 41.56% to 42.87% between the years 2011 to 2017. The world on the other hand, saw a larger increase and had a higher starting percentage. For instance, the world in 2011 had 67.13% of people using safely managed drinking water, and this number later increased to 70.10% in 2017. This is close to a 3% increase which is larger than Mexico's 1.31% increase. This graph also demonstrates that Mexico is behind in both the OECD and the World by a significant amount. In 2017 Mexico lagged behind the OECD by 48.57% as stated previously, and the country lagged behind the rest of the World by 27.23%.

Figure 5.



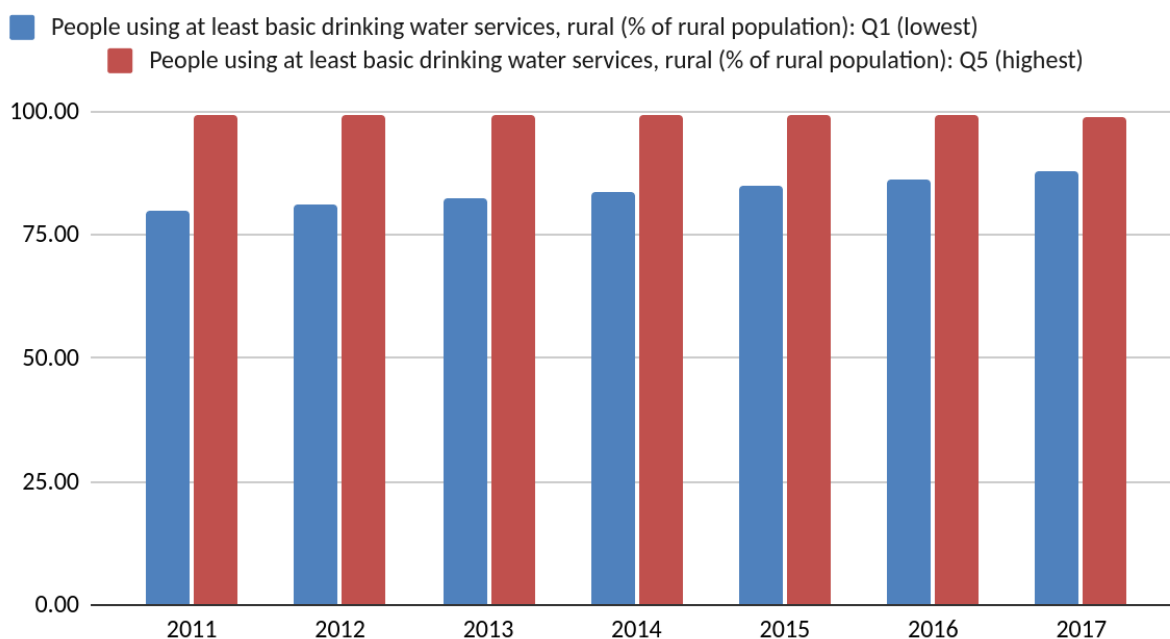
Source: World Bank Health Nutrition and Population Statistics 2020

A different problem is presented when the two definitions of drinking water services are applied to Mexico. As demonstrated in the chart above there exists a significant discrepancy between the use of safely managed drinking water and the use of at least basic drinking water services. As seen in the graph as well is that these numbers have remained fairly stagnant between the years 2011 and 2017. This graph illustrates that access to constant and in-home drinking water that is from an improved source is not a reality for a significant portion of the Mexican population. While least basic services are high, the fact that clean drinking water is not

always available in the home creates concern when a substitute for SSB is water. Having to boil water, purchase filters, or risk illness by using least basic drinking water services provides an explanation for why SSB intake is so high among the Mexican population. For populations that do not have access to safely managed drinking water services SSB can provide a safe alternative albeit in the short term given that these beverages are linked to obesity. While not necessarily correlated this could also be used as an explanation for the increase in bottled water consumption and sales that was noted in the literature review.

Figure 6.

Rural Water Use by Income, Mexico



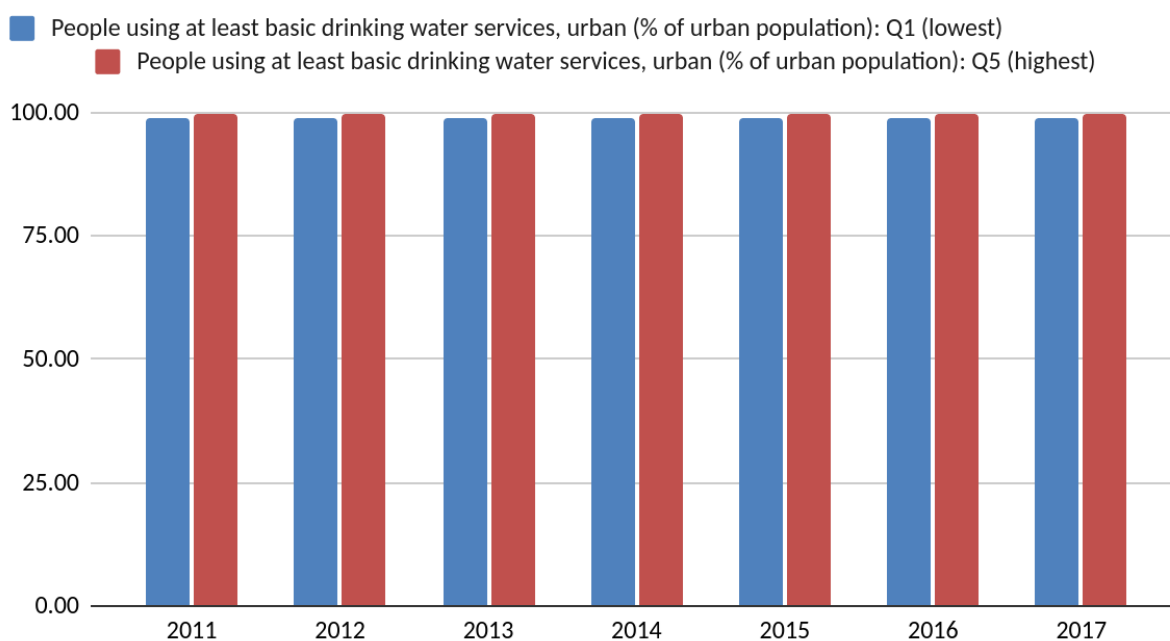
Source: World Bank Health Nutrition and Population Statistics 2020

When limited to the rural population and separated by wealth quintiles, another problem is presented. For the highest wealth quintile, there was very little change from the total

population with all the percentages being at least 99.05% of the population. An interesting note is that there is an actual slight decrease in the use of least basic drinking water services for this quintile. In 2011 the use was 99.16%, and it fell to 99.05% in 2017. For the lowest quintile, there was an increase. In 2011 the lowest quintile had 79.81% with the use of least basic drinking water, and in 2017 87.7 percent of the population used least basic services. This increase appears to be the most drastic increase in the data sets examined. Furthermore, this is the population where income spent on water would be the largest concern. However, it should be noted that this is still the least basic water services indicator which means that the use and access to clean water may still not be easily accessible even if a person qualifies for this category.

Figure 7.

Urban Water Use by Income, Mexico



Source: World Bank Health Nutrition and Population Statistics 2020

For the urban population, the use of least basic drinking water services was high for both wealth quintiles. For the highest quintile, there was a slight decrease again. The use of least basic water use went from 99.83% in 2011 to 99.70% in 2017. There was a slight increase in the lowest quintile. Least basic water use went from 98.71% in 2011 to 98.71 in 2017. It is clear that least basic drinking water use in urban areas is strong. Population shifts to more urban areas are most likely the reason that water infrastructure is better in urban areas.

Figure 8.

Federal Entity	Percentage of the population aged 20 years and over with obesity.	Percentage of the population aged 20 years and over with a previous diagnosis of hypertension	Percentage of the population aged 20 years and over with a previous diagnosis of diabetes
Estados Unidos Mexicanos	36.1	18.4	10.3
Chiapas	29.0	16.2	7.8
Nuevo León	41.4	19.2	12.6

Source: INGEI: ENSAUT 2015 Intercensal Survey

This urban and rural divide is slightly complicated when you compare a state like Chiapas to a state like Nuevo León. Chiapas as discussed in the literature review is a poorer and more rural state of Mexico that struggles with access to water. Nuevo León is a Northern State that contains the third largest city in Mexico, Monterrey. It is more urban than Chiapas, and for this reason it is interesting to compare the municipal data relating to obesity and other related non-communicable diseases. The country's population as a whole is used as a control to compare the difference between a more urban state to a more rural state. For the 2015 intercensal survey data relating to obesity, Chiapas was 7.1% below the national level of 36.1%, and Nuevo León

was 5.3% higher than the national level. This trend continued for hypertension with the more rural state being 2.2% below the national level and the more urban providence being 0.8% higher than the national level. The same can be said for the diabetes rate which was 2.5% lower for Chiapas and 2.3% higher for Nuevo León when compared to the Mexican population as a whole.

When these two states are compared it is clear that the more rural state has less obesity, diabetes, and hypertension, but these rates are not that much lower than the national average with the exception of the obesity rate which is quite a bit lower than the average. The fact that the rates are higher in a more urban state like Nuevo León demonstrates the concerns that urbanization and obesity and other non-communicable diseases are related. In general, this data raises concerns that the soda tax may be unfairly affecting the rural parts of Mexico since their use of least basic drinking water services was lower for lower income individuals. Furthermore, in the case of Chiapas the rates for obesity, diabetes, and hypertension were all lower than the national and urban percentages which is concerning when soda could be potentially supplementing clean drinking water.

In conclusion, Mexico lags behind the rest of the OECD when it comes to safely managed drinking water use. There is also a significant discrepancy between the use of least basic drinking water use and safely managed drinking water use in Mexico. Least basic water use is high for urban areas regardless of wealth quintile, and there is a significant divide for least basic water use in rural areas based on wealth quintile. This data demonstrates that there is an issue with safely managed water use in Mexico. While least basic water use is high for the country overall, the parameters for safely managed drinking water use appear to be the most beneficial for water access and using water as an SSB substitute. The rural lowest wealth quintile

is also important to note because an SSB tax could be more of a burden when compared to other wealth quintiles.

Furthermore, there is a clear urban and rural divide when the cases of Chiapas and Nuevo León are examined. Chiapas had lower percentages for obesity, hypertension, and diabetes, but it also had the least amount of use of least basic drinking water services for the lowest quintile. For this reason, it is concerning that water is supposed to be the substitute for SSB, but access to water for lower income rural families is lower than the rest of the indicators. Additionally, Chiapas had lower rates of obesity, hypertension, and diabetes than the rest of Mexico, but it still faces the same tax as the rest of the country. However, since the use of safely managed drinking water is low for Mexico as a whole, the soda tax as a whole is a slight concern since a cheap and reliable substitute like water may not always be available. On the other hand, obesity rates in Mexico are high, so there does need to be an effective way to manage obesity and other related non communicable diseases.

4. OXXO Penetration and Obesity Rates Data

OXXO is one of the largest convenience chains in Latin America and Mexico. As of 2019, there are 18,233 OXXO locations in Mexico according to Fomento Económico Mexicano (FEMSA), and as discussed in the literature review, changing food environments and diets are a contributing factor to the increases in obesity. In relation to a soda tax, convenience stores are by definition convenient places to pick up high caloric and processed foods and drinks like SSB. For this reason, an examination of OXXO penetration levels and obesity rates by the respective state was implemented to see the relation between the two. There are three levels of penetration that are examined below. Penetration level is the population of a state over the number of OXXO locations. The FEMSA investor presentation from 2019, where the penetration level data was extracted, did not give exact numbers of stores for each state, and each state was instead assigned a level of low, moderate, and medium. A level of low means that the state has one store per 30,000 or more people. A level of moderate means that the state has one store per 10,000 to 30,000 people, and a level of medium means the state has one store per 10,000 or fewer people. For the sake of this thesis, the medium penetration level has been changed to high due to it being the highest penetration level. Moderate and medium have very similar wordings, and high penetration may carry a more serious connotation in a corporate context. The mean was calculated for each level, and a maximum and a minimum were also isolated.

Obesity rates for each state of Mexico were gathered from the 2015 intercensal survey from the National Institute of Statistics and Geography. The obesity rates are for the population over 20 years old, and the overall obesity rate was isolated for each state. An unhealthy diet and food environment are strongly associated with obesity and for this reason, obesity could be a good indicator if convenience store density potentially affects obesity rates. Each state was

assigned a penetration level and obesity rate according to the sources and then separated by penetration level to make examination easier. The result that is hypothesized is that the areas with low penetration levels should correlate with lower obesity rates and be less than the national level, moderate penetration should correlate closer to the national level, and a high penetration level should correlate with higher obesity rates and exceed the national level of obesity.

Figure 9.

State	Percentage of the population aged 20 years and over with obesity	Penetration Level by Population
México	32.73	Low
Nayarit	36.99	Low
Oaxaca	30.50	Low
Tlaxcala	32.32	Low
Campeche	44.90	Moderate
Guanajuato	30.01	Moderate
Guerrero	34.71	Moderate
Michoacán	31.64	Moderate
Puebla	32.87	Moderate
San Luis Potosí	32.62	Moderate
Veracruz	38.98	Moderate
Aguascalientes	32.59	High
Baja California	48.37	High
Baja California Sur	42.85	High
Chiapas	28.95	High
Chihuahua	38.67	High
Ciudad de México	36.34	High
Coahuila	37.61	High
Colima	43.19	High
Durango	37.58	High
Hidalgo	31.17	High
Jalisco	34.83	High
Morelos	33.47	High
Nuevo León	41.42	High
Querétaro de Arteaga	30.61	High
Quintana Roo	48.94	High
Sinaloa	39.95	High

Sonora	43.85	High
Tabasco	47.26	High
Tamaulipas	40.87	High
Yucatán	45.17	High
Zacatecas	33.46	High

Source: INGEI: ENSAUT 2015 Intercensal Survey and FEMSA Investor Presentation 2019

The mean obesity rate for low penetration is 33.13 percent which is lower than the national average obesity rate of 36.07 percent. As suspected, the mean obesity is the lowest of all the penetration levels. The state of Nayarit, the state with the highest percentage of obesity in this category, is higher than the national average of obesity by .92 percent. The lowest recorded obesity rate in this level is 30.5 percent which is significantly lower than the national obesity rate. It is no surprise that the average for all states is lower than the national average, but it is interesting that not all of the states at this level had lower rates of obesity than the national average. Furthermore, it is important to note that this category has the least number of states in it which demonstrates that there are increasing and heavy concentrations of convenience stores in Mexico. It appears likely that in the near future a penetration level of 10,000 or fewer people per store will not exist given that there are only four states left in this category. It appears that urbanization and the changing of the food environment in Latin America are phenomena that can be observed clearly (Popkin and Reardon, 2018).

The mean obesity for moderate penetration is 35.11 percent which again is lower than the national average, albeit by only about one percent. The maximum obesity rate for moderate penetration is 44.9 percent for Campeche which is a lot higher than the national average. The lowest obesity rate recorded is 30.01 percent for Guanajuato which is lower than the national average, but interestingly, 30.01 percent is lower than the minimum for our low penetration group of states. It was suspected that the mean obesity for this penetration level would be closer

to the national average than the low level. However, like the low level, there are not that many states that met the requirement to be categorized as having a moderate penetration level.

For medium penetration, the mean is 38.91 percent which is higher than the national average for obesity in 2015. Medium despite the misleading name is our highest penetration level. Being the highest, it was suspected that the mean would be at minimum the same as the national average or a little bit higher. It should also be noted that this level has the most states which does support the idea that convenience stores are quite literally becoming more convenient in places like Mexico. However, it is important to note that the minimum for this level is actually the lowest minimum overall at 28.95 percent for the state of Chiapas. Although, the maximum is 48.94 percent for the state of Quintana Roo which is the highest overall in the dataset.

To summarize, as suspected the low penetration level had the overall lowest mean obesity rate, and it was less than the national average. However, this was also the penetration level with the least amount of state, that being four, which shows that higher penetration levels of convenience stores such as OXXO are becoming the norm. It should also be noted that the low penetration level did not have the minimum obesity rate of the data set. The moderate penetration level had a mean closer to the national average but slightly less by 1 percent. It was hypothesized that this penetration level would line up more with national statistics. Interestingly, this penetration level still did not have that many states either. It was surprising that only seven states could be included in this category. Finally, the high penetration level category unsurprisingly had the highest mean obesity and was higher than the national average. However, it was interesting that this category also had the minimum and maximum obesity rates in the whole data set. The high penetration level, also, had significantly more states than the other two categories.

5. Conclusion

Key Findings

The findings from the first empirical chapter did reveal that some inequality exists within the context of access to drinking water in Mexico as a whole and within its own regions. Mexico lagged behind the rest of the OECD consistently over the years in terms of “using safely managed drinking water” which displays how the country is not quite up to par with the economic organization. However, in terms of “using least basic drinking water services,” the country did much better than the other indicator. Although, “using least basic drinking water services” is the lesser of the indicators in terms of accessibility and safety. Furthermore, while “using least basic drinking water services” is high, there has not been much change for “using safely managed drinking water” between the years 2011 to 2017. Additionally, once divided into rural and urban populations and wealth quintiles it is revealed that lower-income individuals in rural areas had the least amount of people “using least basic drinking water services.” This is concerning given the regressivity of an SSB tax, however, access has increased since 2011 which demonstrates that some improvements are being made. Since “using safely managed drinking water” data is still not improving much after the implementation of the tax, there still exists some significant room for improvement of the water system in Mexico.

Our findings from comparing Chiapas and Nuevo Leon to the overall NCD rates of Mexico revealed a further urban and rural divide in the context of obesity. Nuevo Leon’s rates for obesity, hypertension, and diabetes are higher than both Chiapas and Mexico as a whole. Chiapas, on the other hand, has lower rates for all these NCDs in comparison to the rest of Mexico. This data reveals that a more urbanized area such as Nuevo Leon could potentially be more at risk for weight-related NCDs. Although, as revealed in the OXXO chapter, Chiapas,

despite being a more rural location in Mexico, still has a high concentration of convenience stores.

The findings from the OXXO and obesity empirical section highlight how convenience store culture and urbanization have drastically changed the food system in Mexico. With 18,233 OXXO in 2019, the largest convenience store chain has managed to have a high penetration level in the majority of Mexican states. As was stated in the hypothesis for this data, it was suspected that a higher penetration level should have a higher overall obesity rate for the states at that level. The respective means for the low, moderate, and high penetration levels are 33.13 percent, 35.11 percent, and 38.91 percent. The 2015 intercensal Encuesta Nacional de Salud y Nutrición obesity rate for Mexico as a whole is 36.07 percent, so the penetration levels seem to line up linearly with this percentage which was suspected. However, the distribution of the states was not very equitable with the high penetration level having the overwhelming majority of the states. This majority, also, caused both the minimum obesity rate and the maximum obesity rate to appear at the high penetration level. Interestingly, Chiapas which is examined in the previous section was the minimum obesity level at 28.95 percent. There are seven states including Chiapas that are below the national average obesity rate in the high penetration level. This is interesting, but it does highlight how the other 14 obesity rates are high enough to raise the mean.

Discussion

There is still a need for the drinking water environment to improve in Mexico. While the lowest quintile in rural areas has seen the most drastic improvement, there is still a significant lag when it comes to using sources that are free from contamination and are located on the premises. For this reason, it is of great concern that the use of “safely managed drinking water” has not increased drastically since the implementation of the SSB tax. Water is the ideal substitute for

SSB, so it would be desirable for access to the safest forms of drinking water to increase. In the terms of a regressive tax, the added tax burden of paying more for soda or using soda as a substitute for water when access to clean water is limited is highly concerning. Much of the tax revenue from the SSB tax has not gone to improving water which is a problem considering it could add additional burdens to the lowest income individuals in Mexico. Specifically, only 900,000 dollars of the 1.2 billion dollars collected in the first year of the tax was authorized for use in a school water fountain project (Kilpatrick, 2015). However, preventing the future costs that obesity and other NCDs could cause is a potential benefit of an SSB tax. For this reason, it is not necessarily correct to say that the SSB tax is not useful or harms people, and instead, improvements should be made on the distribution of revenue to improve water quality.

The urban and rural divide of obesity, hypertension, and diabetes reveals that the needs of urban and rural areas may be different. This data may demonstrate that obesity prevention is more urgent in urban areas. However, rural areas tend to have less access to health care, and obesity and its related issues can lead to astronomical health costs in the long run. For this reason, an obesity policy of some form is necessary. Noticing these divides is still important to understand that certain areas may have more urgent needs than others. The data is also important to understand the relationship between obesity and urbanization.

The findings from the OXXO and obesity empirical chapter reveal how convenience stores may have an effect on obesity rates. It also reveals how obesity is a systemic issue. In relation to an SSB tax, it is clear that the majority of Mexican states have a high penetration of OXXO locations, and it demonstrates how while costs for SSBs have risen, access to SSB appears to be an issue. This issue demonstrates that legislation such as the ban on the sale of sugary drinks to children in Oaxaca. Legislation such as this demonstrates how obesity policy

needs to address multiple aspects of life. The price of an SSB can rise, but children and individuals can still have quick and convenient access to these types of beverages (Argen, 2020). Within the theoretical framework, the idea of urbanization contributing to the nutritional transition does align with the data. This empirical chapter revealed that the majority of Mexican states have a high penetration of OXXO stores, and the mean obesity rate for high penetration is higher than the overall Mexican obesity rate. This aligns with the idea that urbanization leads to nutritional transition through access to more junk foods and sugary beverages which combined with a more sedentary lifestyle causes an increase in NCDs such as obesity.

Conclusion

To summarize, obesity is a complex issue that has been perpetuated by ongoing urbanization and nutritional transition. An SSB tax is a notable obesity policy because it attempts to indirectly influence consumer choice away from choosing unhealthy beverages. However, like other sin taxes, an SSB tax is regressive, and the lowest income individuals are the most affected. Furthermore, the percent of overweight individuals and the healthcare costs for Mexican citizens are still rising. The data in this thesis revealed that there are concerns for regressivity especially for lower income individuals when it comes to drinking water. Rural and urban areas seem to experience different rates of obesity and other NCDs which may highlight how urbanization is a contributing factor to obesity. The examination of OXXO penetration data revealed that there may be a pattern between convenience stores and obesity rates. An SSB tax may be an effective way in reducing consumption, but underlying issues should be addressed. There exist issues with access to water which should see some of the tax revenue from SSBs. It is important that the revenues from this tax benefit lower income individuals and households to issue the benefits of the tax outweigh the regressivity. Finally, the growth and the current number of convenience

stores are an alarming phenomenon in the context of the nutritional transition, and policy needs to address that these stores contribute to the sale of other junk foods besides SSB. Obesity is not a health issue that can be solved with one form of policy, and it is important to examine potential pitfalls in preventing future health costs.

Bibliography

- Agren, D. (2020, August 6). *Mexico state bans sale of sugary drinks and junk food to children*.
<https://www.theguardian.com/food/2020/aug/06/mexico-oaxaca-sugary-drinks-junk-food-ban-children>
- Allcott, H., Lockwood, B., & Taubinsky, D. (2019). *Should We Tax Sugar-Sweetened Beverages? An Overview of Theory and Evidence*. [10.3386/w25842](https://doi.org/10.3386/w25842)
- Bahia, L., Coutinho, E. S. F., Barufaldi, L. A., de Azevedo Abreu, G., Malhão, T. A., Ribeiro de Souza, C. P., & Araujo, D. V. (2012). The costs of overweight and obesity-related diseases in the Brazilian public health system: cross-sectional study. *BMC Public Health*, 12(1). [10.1186/1471-2458-12-440](https://doi.org/10.1186/1471-2458-12-440)
- Bergallo, P., Castagnari, V., Fernández, A., & Mejía, R. (2018). Regulatory initiatives to reduce sugar-sweetened beverages (SSBs) in Latin America. *PLoS ONE*, 13(10), e0205694.
[10.1371/journal.pone.0205694](https://doi.org/10.1371/journal.pone.0205694)
- Bogart, W. A. (2013). Law as a Tool in “The War on Obesity”: Useful Interventions, Maybe, But, First, What’s the Problem? *J. Law. Med. Ethics*, 41(1), 28–41. [10.1111/jlme.12003](https://doi.org/10.1111/jlme.12003)
- Colchero, M. A., Molina, M., & Guerrero-López, C. M. (2017). After Mexico Implemented a Tax, Purchases of Sugar-Sweetened Beverages Decreased and Water Increased: Difference by Place of Residence, Household Composition, and Income Level. *J. Nutr.*, 147(8), 1552–1557.
[10.3945/jn.117.251892](https://doi.org/10.3945/jn.117.251892)

Colchero, M. A., Rivera-Dommarco, J., Popkin, B. M., & Ng, S. W. (2017). In Mexico, Evidence Of Sustained Consumer Response Two Years After Implementing A Sugar-Sweetened Beverage Tax. *Health Affairs*, 36(3), 564–571. [10.1377/hlthaff.2016.1231](https://doi.org/10.1377/hlthaff.2016.1231)

Encuesta Intercensal 2015 y registros administrativos. (2015). La Encuesta Nacional de Salud y Nutrición (INEGI).

FEMSA. (2019, June). *Investor Presentation – June 2019*.

Fox, A., Feng, W., & Asal, V. (2019). What is driving global obesity trends? Globalization or “modernization”? *Global Health*, 15(1). [10.1186/s12992-019-0457-y](https://doi.org/10.1186/s12992-019-0457-y)

Health Nutrition and Population Statistics. (2020). World Bank.

Health Nutrition and Population Statistics. (2021). World Bank.

James, E., Lajous, M., & Reich, M. R. (2020). The Politics of Taxes for Health: An Analysis of the Passage of the Sugar-Sweetened Beverage Tax in Mexico. *Health Systems & Reform*, 6(1), e1669122. [10.1080/23288604.2019.1669122](https://doi.org/10.1080/23288604.2019.1669122)

Kilpatrick, K. (2015, August 19). *Taxing soda, saving lives*.

<http://projects.aljazeera.com/2015/08/mexico-obesity/soda-tax.html>

Lopez, O., & Jacobs, A. (2018, July 14). *In Town With Little Water, Coca-Cola Is Everywhere. So Is Diabetes*. <https://www.nytimes.com/2018/07/14/world/americas/mexico-coca-cola-diabetes.html>

Popkin, B. M., & Reardon, T. (2018). Obesity and the food system transformation in Latin America. *Obesity Reviews*, 19(8), 1028–1064. [10.1111/obr.12694](https://doi.org/10.1111/obr.12694)

- Popkin, Barry M. (1999). Urbanization, Lifestyle Changes and the Nutrition Transition. *World Development*, 27(11), 1905–1916. [10.1016/s0305-750x\(99\)00094-7](https://doi.org/10.1016/s0305-750x(99)00094-7)
- Puig, A., Pagán, J. A., & Wong, R. (2009). *Assessing Quality Across Healthcare Subsystems in Mexico*. 32(2), 123–131. [10.1097/jac.0b013e31819942e5](https://doi.org/10.1097/jac.0b013e31819942e5)
- Roache, S. A., & Gostin, L. O. (2017). The Untapped Power of Soda Taxes: Incentivizing Consumers, Generating Revenue, and Altering Corporate Behavior. *Int J Health Policy Manag*, 6(9), 489–493. [10.15171/ijhpm.2017.69](https://doi.org/10.15171/ijhpm.2017.69)
- Rtveladze, K., Marsh, T., Barquera, S., Sanchez Romero, L. M., Levy, D., Melendez, G., Webber, L., Kilpi, F., McPherson, K., & Brown, M. (2014). Obesity prevalence in Mexico: impact on health and economic burden. *Public Health Nutr.*, 17(1), 233–239. [10.1017/s1368980013000086](https://doi.org/10.1017/s1368980013000086)
- Salinas, J. J., Al Snih, S., Markides, K., Ray, L. A., & Angel, R. J. (2010). *The Rural-Urban Divide: Health Services Utilization Among Older Mexicans in Mexico*. 26(4), 333–341. [10.1111/j.1748-0361.2010.00297.x](https://doi.org/10.1111/j.1748-0361.2010.00297.x)
- Sánchez-Pimienta, T. G., Batis, C., Lutter, C. K., & Rivera, J. A. (2016). Sugar-Sweetened Beverages Are the Main Sources of Added Sugar Intake in the Mexican Population. *J. Nutr.*, 146(9), 1888S-1896S. [10.3945/jn.115.220301](https://doi.org/10.3945/jn.115.220301)
- Social Determinants Of Health*. (2021). World Health Organization. https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

Studdert, D. M., Flanders, J., & Mello, M. M. (2015). Searching for Public Health Law's Sweet Spot: The Regulation of Sugar-Sweetened Beverages. *PLoS Med*, 12(7), e1001848.

[10.1371/journal.pmed.1001848](https://doi.org/10.1371/journal.pmed.1001848)

Torres, F., & Rojas, A. (2018). Obesidad y salud pública en México: transformación del patrón hegemónico de oferta-demanda de alimentos. *RPD*, 49(193).

[10.22201/ieec.20078951e.2018.193.63185](https://doi.org/10.22201/ieec.20078951e.2018.193.63185)

Tuckman, J. (2019, February 15). *Coca-Cola country in southern Mexico – photo essay*.

Turner, C., Kalamatianou, S., Drewnowski, A., Kulkarni, B., Kinra, S., & Kadiyala, S. (2019). *Food Environment Research in Low- and Middle-Income Countries: A Systematic Scoping Review*.

[10.1093/advances/nmz031](https://doi.org/10.1093/advances/nmz031)

World Health Organization. (2017). *Taxes on sugary drinks: Why do it?* World Health Organization.

<https://apps.who.int/iris/bitstream/handle/10665/260253/WHO-NMH-PND-16.5Rev.1-eng.pdf;jsessionid=0B08986FEA7CBB64F974A9E85810539B?sequence=1>

Yates-Doerr, E. (2015). *Weight of Obesity*. Univ of California Press.